HIGHLIGHTED 2005 ACCOMPLISHMENTS

Answering Fundamental Science Questions about Chemical Agents

Researchers at ECBC are learning more every year about chemical agents and their impact on human health and the environment. Better investigative technologies, such as nuclear magnetic resonance, allow researchers to explore deep inside environmental samples to better understand how agent interacts with different materials. From this research, scientists understand much more about the properties and effects of chemical agent exposure and are applying this new understanding to refining toxicity estimates, updating equipment requirements and changing basic field operating procedures for warfighters and emergency responders.

In the Agent Fate program, which was a major research initiative at ECBC in 2005, researchers are studying what happens to chemical agents when they have contaminated operationally relevant surfaces such as concrete and soil. The program addresses the following questions: What effect will different surfaces have on the behavior of agents? What are the vapor and contact hazards? How much impact do environmental conditions have on a contaminated surface? When will a surface be safe?

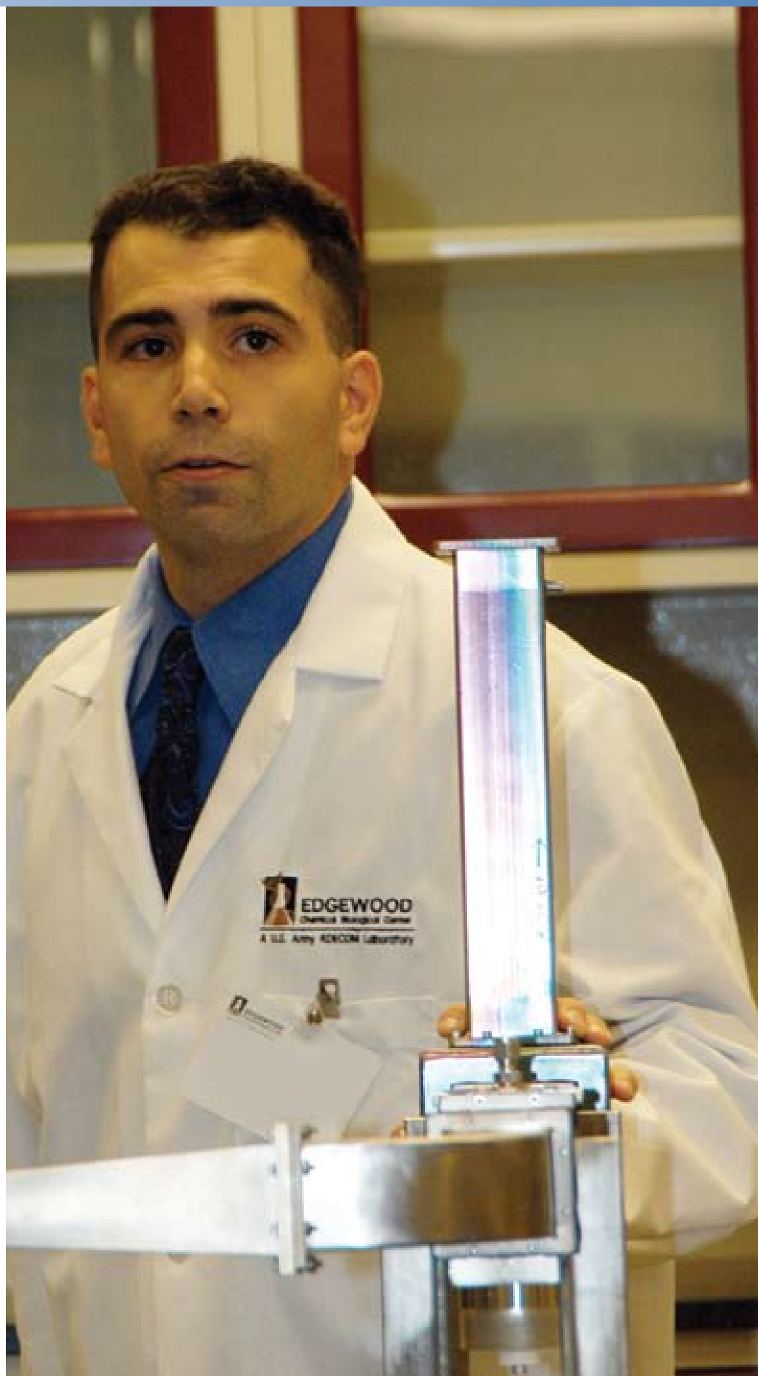
Currently, field manuals and other sources of information conflict. An example of this conflict is found in comparing the Army Field Manuals 3-4 and 3-9, which are technical manuals used by warfighters to determine operational procedures. One manual claims that nerve agent on grass is a vapor hazard for 18-20 hours after contamination; for the same environmental conditions, the other manual claims the vapor hazard exists 1800-3600 hours after contamination. Through advanced research techniques and rigorously validated data, scientists are working to provide authoritative data and resolve conflicting information.

There are two major areas of experimental focus in the Agent Fate program—measuring the evaporation rates of agents from surfaces and understanding the surface interactions and chemistry. Important variables being studied include temperature, wind speed, relative humidity, agent drop size, surface and agent. Surfaces investigated include terrain materials such as sand, soil and grass as well as infrastructure building materials like concrete and asphalt. To test every possible combination of agent, surface and environmental conditions would require over 10,000 experiments so researchers developed a "design of experiments" approach to focus research on key combinations and perform trend calculations for others. This approach reduced the total number of experiments to be conducted, but scientists still faced conducting thousands of experiments in order to obtain the high-fidelity data necessary.

In 2005, ECBC completed the design and development of a wind tunnel capable of matching all of the desired environmental conditions, including temperature and wind profiles, while fitting within a standard chemical fume hood. To complement the tunnel, new vapor sampling devices were developed with more versatility to cover a broader range of agents and surfaces. This instrument enables the measurement of evaporation processes with precise wind speed, temperature and relative humidity controls and multiple video and vapor monitoring capabilities. The wind tunnel design was replicated to create eight functioning wind tunnels in order to complete the research in 2006.

Another part of Agent Fate research included studying surface/agent interactions and chemistry. Agent may adsorb into a porous surface and be trapped until conditions change. In 2005, ECBC scientists learned surprising new information about chemical agents and their interaction with surfaces. Mustard agent, for instance, is more persistent in porous materials than anticipated and may not be detectable by traditional field methods. Also, the reaction products for mustard in concrete contain a mixture of toxic and non-toxic materials. Furthermore, a light rain may cause agent trapped in porous materials to resurge as a vapor hazard. This was shown for 34 rain events over three weeks on the same original sample. This data prompted the Air Force to change their operating procedures. Similarly, researchers found that the nerve agent VX, an organophosphate similar in chemical structure to pesticides, persists in soil and concrete much longer than originally thought and can be reactivated by rain events. This data has been incorporated into military prediction tools and operating manuals, which previously had underestimated the hazards of chemically contaminated surfaces. Researchers also shared the new data in 2005 with the scientific community, delivering over 25 presentations, journal articles and technical reports.

As the research continues into 2006, ECBC expects data from the Agent Fate program to not only refine operating procedures and predictive tools that assist authorities to determine the best course of action after a contamination event, but to have a major impact on other programs. The low level chemical warfare agent toxicology research program will benefit from the technical data produced by the Agent Fate program by determining the toxic hazard associated with agents on and within surfaces. Similarly, decontamination studies and the Agent Fate program work together in a synergistic and complementary fashion to produce a more complete picture of the chemical agent hazards and methods of mitigating the threat.



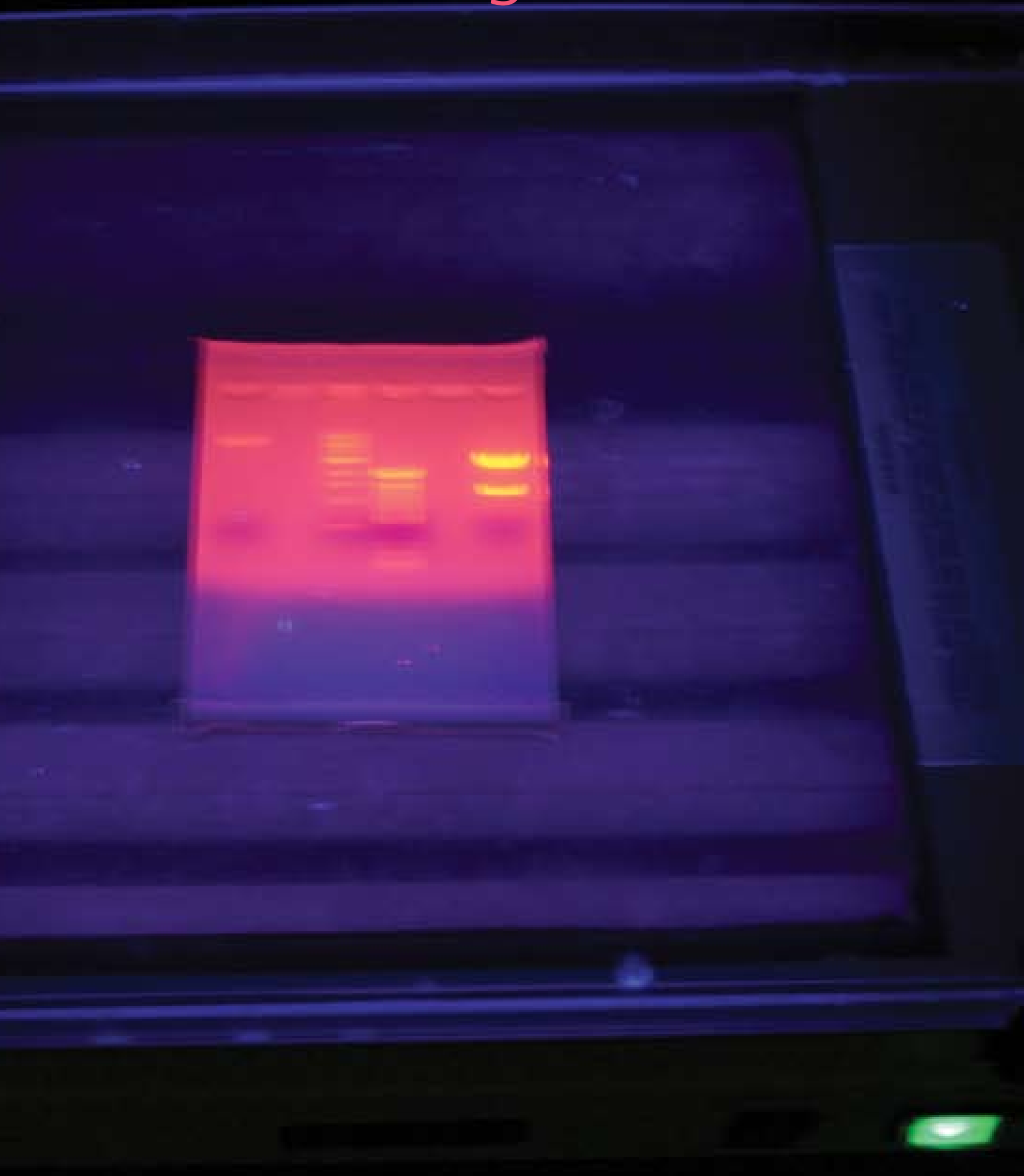
The Environmental Fate of Agents research is conducted under the auspices of Defense Technology Objective CB.42. Defense Technology Objectives are recognition of the most important defense science and technology activities and are reviewed by both Department of Defense senior managers and Congress.

Understanding Viruses

"Both history and science clearly tell us that influenza pandemics are inevitable. The next pandemic could emerge from the current H5N1 strain that now affects numerous countries in Asia, Europe, the Middle East and Africa. The next pandemic also could emerge from another influenza strain, and we must be ready for both of these possibilities," said Centers for Disease Control and Prevention Director Dr. Julie Gerberding, in testimony before Congress in March of 2006.

President Bush's November 2005 National Strategy for Pandemic Influenza states that in any given year, seasonal influenza viruses cause 36,000 deaths and cost $10 billion nationwide. Worse, a pandemic in this country, such as the one in 1918, could kill millions of Americans and wreak havoc on our economy and way of life.

Understanding the properties of viruses and how we can protect the warfighter is a critical part of ECBC's mission. While much of the national strategy is focused on medical countermeasures such as vaccines, ECBC's focus is on answering the fundamental science questions about viruses and their behavior in the environment, and providing physical countermeasures such as rapid detection and identification devices, and high-fidelity simulants that researchers can safely use in the laboratory to further scientific understanding of viral threats.



Understanding Viruses

Understanding How Long a Virus is Infectious

ECBC completed a major study in 2005 on the inactivation rate of viruses following release into the environment, either as a deliberate act of terrorism or through human transmission such as a cough or sneeze. This study, published in the Journal of Virology in November 2005, found a correlation between the amount of sunlight a specific geographic location receives and the rate of inactivation of a virus released in that location.

It is known that ultraviolet radiation in sunlight is the primary virucidal agent in the environment but different cities in the world have widely varying exposure to sunlight, primarily based on time of year, latitude, and cloud cover. Prior to this work done at ECBC, scientists had no way to predict how long a virus would remain infectious based on where and when it is released into the environment.

Two types of solar radiation—direct and indirect—can inactivate viruses and are roughly equal in intensity on a clear day. Climate, pollution, cloud cover and ozone levels lower the intensity of solar radiation, and reduce virus inactivation. Interestingly, even shadows from natural or artificial structures, such as trees and buildings, can provide the protection needed in order for a virus to remain infectious.

Using these variables, ECBC scientists found that at the beginning of the usual flu season (December), influenza virus exposed to full sunlight will be reduced by 99 percent (2 logs) during a single day in Miami and in Mexico City, and by 90 percent (1 log) in Los Angeles and New Delhi, but will remain infectious in London, Seattle and other northern cities because of the low levels of solar radiation. This allows continued risk of re-aerosolization and human infection. By spring equinox, solar inactivation improves in parallel with a general decrease in flu cases. The correlation between low and high solar radiation and high and low disease prevalence, respectively, suggest that inactivation of viruses in the environment by solar radiation plays a major role in the seasonal occurrence of influenza contagion.

The predictive model developed by ECBC will be used by military planners and it also can be applied by countries around the world to prepare for influenza outbreak.

The Calculations

We calculated virus survival following solar exposure by comparing the sensitivity of Influenza A virus to monochromatic 254-nm wavelength light (mid-ultraviolet or UVB) obtained in the laboratory with solar radiometry for each city. These calculations were weighted by a 254 nm-normalized UV action spectrum for virus inactivation previously determined in an approach that agreed with experimental data. The UV fluence (at 254 nm) to inactivate Influenza A virus one log (survival level of 10 percent) has been reported as 23.5 J/m^2. We used this value to calculate maximum virucidal (254-nm equivalent) UV fluence for full day solar exposure by a method developed previously for viruses of interest in biodefense. Solar radiometric data was available at 33 reporting sites in North America and one in New Zealand, and provided on a continual year-round basis by the USDA UVB Monitoring and Research Program (http://uvb.nrel.colostate.edu/UVB/).

The actual radiometry sites are not located within city limits but nearby, e.g., data from Beltsville, Maryland can be used for Washington, D.C., 12 miles away. The noon-time radiometric data from the USDA UVB Monitoring and Research Program were weighted by values from the 254 nm-normalized action spectrum for UV inactivation of viruses, corrected to account for all UVB wavelengths to give a 254-nm equivalent UV flux for the selected site and time of year, and then used to calculate the corresponding fluence for the entire day. World locations whose virucidal solar radiation was not readily available were matched to North American locations of similar latitude as nearly as possible, and data extrapolated from corresponding solar zenith angles and average fluence during the equinoxes. Solar zenith angle for summer solstice was calculated by subtracting 23.5° from the latitude of the location (for all extra-tropical locations); solar zenith angle for winter solstice by adding 23.5° to the latitude (for all extra-tropical locations).

Understanding Viruses

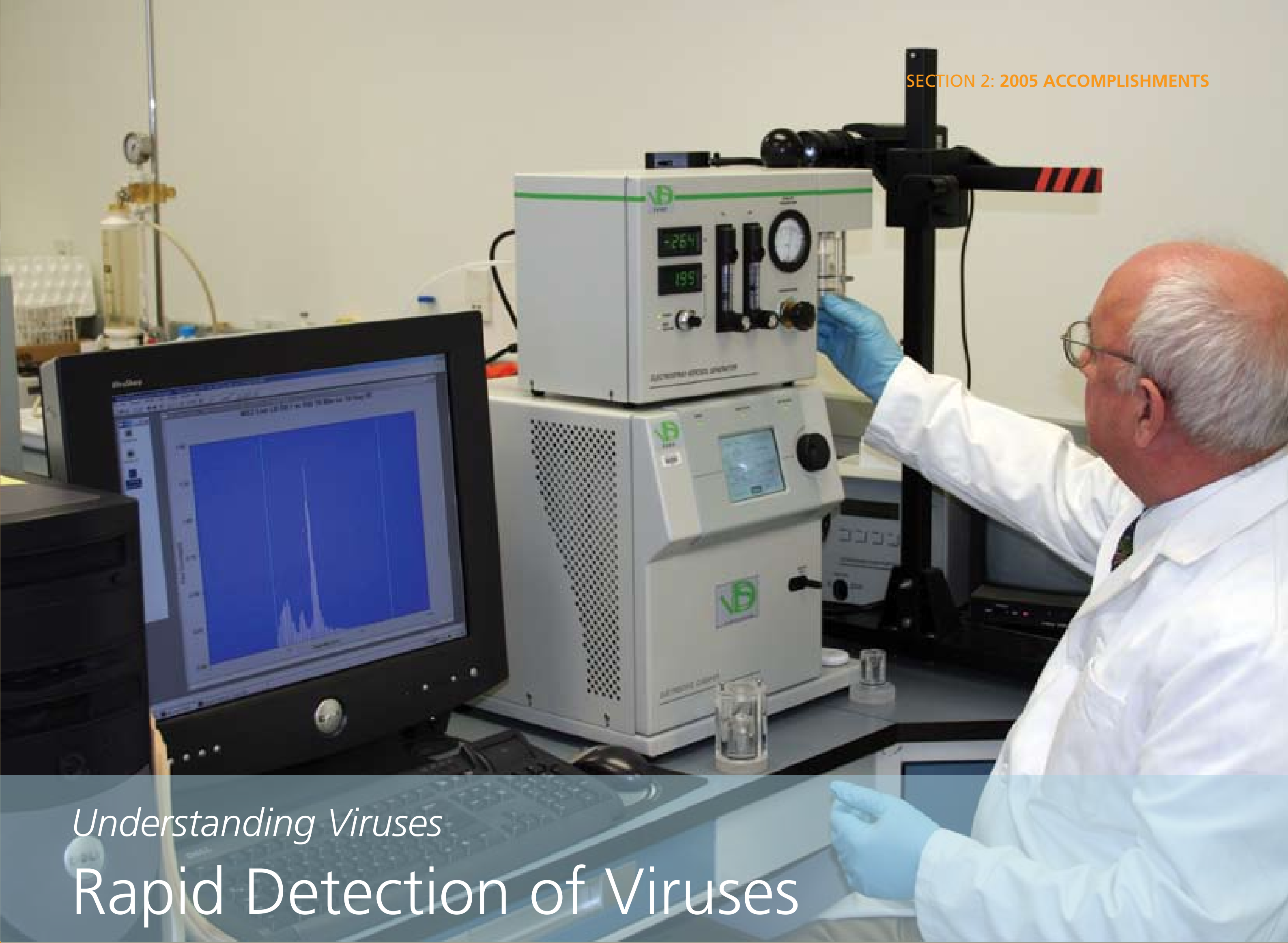
Viral Simulants

In order to develop a thorough understanding of viruses and optimize countermeasures, thousands of laboratory experiments must take place. In certain situations working with a pathogenic virus is necessary. However, many of these experiments may be conducted using a simulant virus that mimics the properties of the real virus but is far safer to work with. For scientists, a simulant reduces the risk of exposure to an infectious disease and increases their productivity because of reduced logistical requirements. It also allows more accurate equipment testing in large chambers or out of doors, which is necessary in order to assess system performance but cannot take place with pathogenic virus material.

An ideal simulant shares general physical and biological properties with the pathogen of concern, but is not infectious to humans. The harmless bacteriophage MS2 has been used for decades in the biodefense research, development, testing and evaluation communities but has several drawbacks. Most importantly, it is not the same size or shape as most of the recognized viral threat agents, and in particular, lacks similarity with orthopoxviruses, a family that includes variola virus, the causative agent of smallpox.

ECBC scientists are in the forefront of the search for more suitable simulant viruses. In recent years, attention has been focused on a group of simulants known as baculoviruses, which have been used safely for decades as "natural" anti-insect agents. While non-pathogenic to humans, other higher animals and plants, viruses in the baculovirus group resemble poxviruses in their physical construction, size and genome composition much more closely than bacteriophage MS2. Recently, ECBC developed antibody-based and polymerase chain reaction assays for the detection of baculoviruses.

In 2005, ECBC scientists filed a patent application for the use of baculoviruses as simulant viruses in biodefense work. ECBC is also pursuing a collaboration with our French Ministry of Defense counterpart, the Centre d'Etudes de Bouchet, which also has an interest in pursuing this research.



Understanding Viruses

Rapid Detection of Viruses

Current methods of virus detection and identification, which rely on the use of antibodies and reagents, are effective for clinical use but have several limiting factors when applied to use in the field. Specialized skills and equipment and extended analysis time are required in order to accurately analyze a sample for the presence of a virus. This makes rapid, accurate detection of a virus before it infects a large population of soldiers or civilians a difficult feat to accomplish.

A rapid field screening system for viruses would be a valuable capability, particularly as the threat of a possible pandemic caused by a flu virus or genetically engineered threat becomes of greater concern to the international science community. In 2005, ECBC achieved a milestone in this area with the development of a new Real Time Non-Specific Viral Detection system, which uses analysis of the physical properties of viruses in order to allow initial field screening of an environmental sample. Viruses are collected, sized and a concentration determined without the use of biochemical reactions. The system also can count known viruses, unknown viruses (viruses without names), mutations and virus-like particles at the same time and in the same sample.

A small amount of sample is placed into a capillary tube in a sealed chamber. The sample is then aerosolized into an electric field where the individual particles become electrically charged. The charged sample then is passed into a column in which an electric field surrounds the charged particles. The speed of each particle's travel through this electric field is proportional to the mass/charge ratio of the particles. After passing through the chamber, the particles then pass into a counting chamber where the number of particles of each mass/charge ratio (e.g., size) is scored. The data are then processed in a computer where the mass/charge ratios are converted to an estimate of the size of the particles. A video display then shows the distribution of particles by size and concentration. Results are stored to a file, which can then be further analyzed in a laboratory in order to confirm the identity of the virus.

In 2005 the system successfully detected Influenza A (91nm) - the bird flu - and examined its stability over time, and Influenza B (102nm). It has detected several of the hepatitis viruses, as well as others of interest from a wide selection of environments. This new approach provides for a quick means to create dose-response or fate curves for viruses of interest and various treatments, such as antiviral drugs, temperature, pH and outdoor exposure. In 2006, scientists are looking to partner with industry to reduce the size of this technology so that it can be made into a portable virus detector. Its value to the military and civilian medical and emergency responder community would be its ability to accurately screen large numbers of samples in a small amount of time and at a fraction of the cost of the more extensive antibody-based identification systems.

Detecting Low Volatility Materials

As the potential chemical warfare threat has grown to include the possible use of toxic industrial chemicals and military threat agents with low volatility properties, the detection equipment carried by the warfighter must be enhanced. In order to quickly field a capability to address low volatility materials, ECBC adapted existing chemical detection equipment to meet this need.

Fielded equipment relies on agent in its gas phase— vapor—passing through the detection mechanism. Low volatility materials have little or no matter in the gas phase and consequently low vapor pressure. ECBC scientists found that by simply engineering a heating mechanism into the detector, more material could be transported for detection.

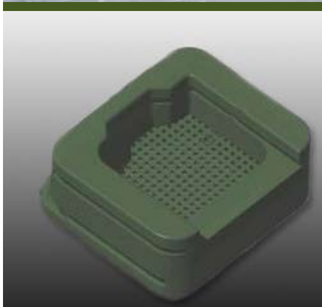
In 2005, ECBC scientists and engineers focused on modifying the M256A1 Chemical Agent Detector by adding a new capability that collects liquid and solid samples. Engineers and scientists had in previous years devised a simple but ingenious small plastic adaptor that clips onto the M256A1 sampler. Using this adaptor, a liquid or solid sample collected using M8 paper or M9 paper is attached to the M256A1 and heat is applied to raise the sample temperature so that enough vapor is produced to allow detection to take place. ECBC developed and fielded 3,000 kits within three weeks. Also in 2005, ECBC created several design configurations for this new kit and conducted an evaluation with users to gather feedback on preferred configuration. ECBC also fabricated test items and developed a test plan to perform required technical testing. ECBC is conducting this testing in 2006.

In 2006, ECBC's emphasis will be on further improving the low volatility detection system and adding quality and reliability to the M256A1 kit. ECBC will be working with the manufacturer to review the current manufacturing process and technical data package to determine ways to add more functionality.

The M22, an automatic chemical agent alarm system capable of detecting and identifying standard blister and nerve agents, was adapted for detection of low volatility compounds in 2005. Engineers developed a unique inlet and agent collection device to capture and process agent samples and a thermal or insulated wrap was developed to maintain required internal temperatures in cold weather. ECBC also conducted environmental, field and laboratory tests and analyzed test results which led to refinement of the detection algorithm for this new version of the M22. The M279 Surface Sampling System, an M22 auxiliary item, was also enhanced by ECBC for cooperative use with the modified system. Specifically, the M279 internal components were upgraded to provide the required heat for the sampling mission.

In ECBC's research laboratories, scientists are also working to integrate detection of low volatility materials into remote sensing technologies, such as the M21. Remote chemical sensing can be accomplished by analyzing infrared light emitted or absorbed by a chemical cloud and identifying the presence of agents in the cloud by comparing its spectral signature—or unique optical fingerprint—to that of a baseline library signature, typically one that is acquired in a laboratory with the actual agent. Recently, ECBC has added spectral signature data for low volatility materials to this library of agent signatures and in 2005, enhanced the accuracy of these reference signatures by developing a new method, called spectroscopic ellipsometry, to measure optical constants of solids and liquids. The Joint Services Lightweight Standoff Chemical Agent Detector, which employs infrared spectroradiometry and the Artemis, which employs infrared laser light detection and ranging technology to detect hazardous clouds at kilometer distances, both rely on accurate knowledge of these optical constants.

Low volatility materials are an area of concern for today's warfighter but not an insurmountable problem. With creative engineering and careful science, ECBC put new capabilities in the hands of the warfighter in 2005.



Advancing Air Purification Technology and Application

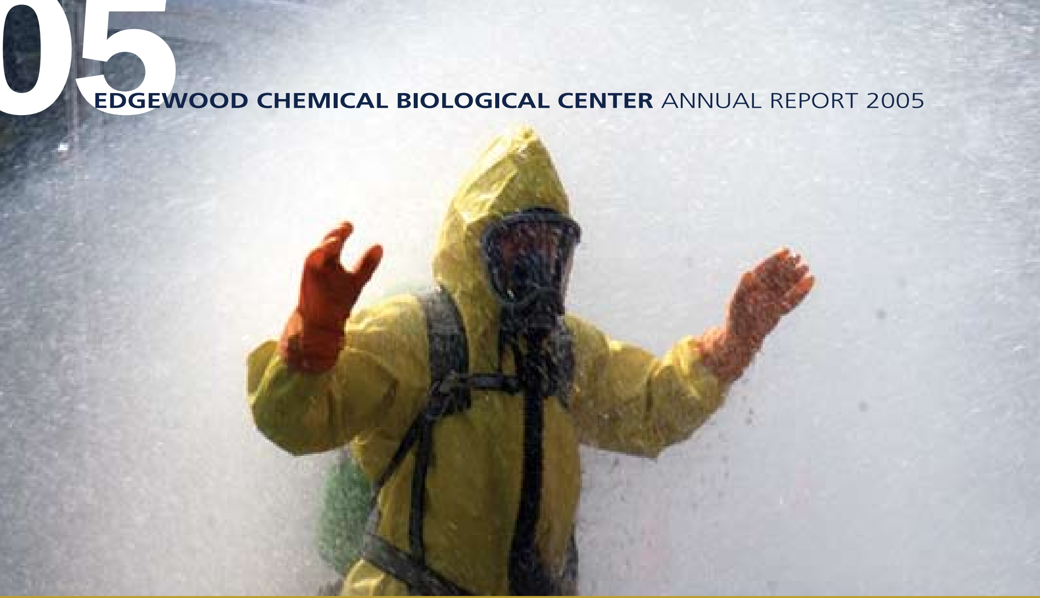
Air purification technologies allow warfighters and first responders to operate in contaminated environments. Protective masks are used by fire fighters in smoke-filled environments and by warfighters when the threat of toxic materials is present. Air purification technologies are also widely used in buildings and vehicles to protect the occupants against contamination. ECBC's work in this area is focused on developing new engineering controls and filtration materials that ensure a contaminant-free environment for warfighters and civilian workers.

Highly visible government facilities, particularly in the nation's capital, and facilities where sensitive operations take place, are considered by homeland security experts as targets for possible terrorist attack. Much has been done to address these facilities' vulnerabilities, including designing and installing air filtration systems to protect against chemical, biological or radiological contamination. In 2005, ECBC installed new air filtration systems in several facilities across the nation. Additionally, ECBC engineers and technicians provided follow-on support, including continuous surveillance, preventative maintenance and regular re-certification services of existing systems. Because of ECBC's efforts in 2005, critical government facilities have state-of-the-art protection.

Carbon is the primary filtration material used in protection systems. When impregnated with certain metals, the carbon filter can protect against a wider range of threats. In 2005, ECBC and its commercial partners advanced the technology of filter media and made available a new filter material formula for incorporation into fielded systems. Specifically, ECBC conducted qualification testing of M48A1 and M98 filters incorporating an advanced adsorbent designed to protect against toxic industrial chemicals. Full qualification, technical data documentation, and transition to the field are expected to be completed in 2006.

In addition to designing new filtration materials, ECBC is enhancing new air purification system technologies for use in buildings and vehicles. For example, regenerative filtration is a self-cleaning air handling system that eliminates the need to change filters in a contaminated environment. A regenerative filtration system employs two adsorption beds—one to filter the incoming air while a second is regenerated by low-pressure or high-temperature purging. In this way, operating and lifecycle costs are reduced and mission effectiveness is improved. In 2005 ECBC began studying how to incorporate a regenerative filtration system into the new Expeditionary Fighting Vehicle, an amphibious fighting vehicle being developed for the United States Marine Corps that is scheduled to enter production in 2007.

Another air purification system under development is catalytic oxidation. This technology uses high temperatures to destroy chemical and biological threats. Widely used in industry, ECBC is working in collaboration with industry partners to adapt catalytic oxidation technology for military application. In 2005, ECBC worked with industry to mature the technology and improve its scalability. Also, ECBC tested the technology and demonstrated its effectiveness against toxic industrial materials of interest to the military and the homeland defense community.



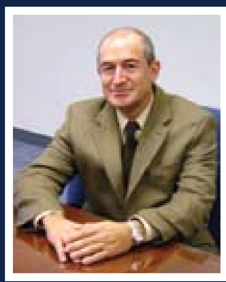
Developing a New Decontamination Standard

Existing methods for evaluating the effectiveness of sporicidal treatments needed improvement to be more quantitative, rapid, economical, flexible and environmentally friendly. Last year, ECBC scientists developed an improved method for evaluating the effectiveness of sporicides, such as decontaminants for defense applications and products for household or commercial use. This new test method was adopted in 2005 as the new international standard by the American Society for Testing and Materials (ASTM). This standard is known as E 2414-05, Quantitative Sporicidal Three-Step Method to Determine Sporicidal Efficacy of Liquids and Vapor or Gases on Contaminated Carrier Surfaces.

The method has several advantages. Instead of a 30-day wait, results are produced via overnight incubation. Carrier surfaces are inexpensive enough to be disposable. Also, this test method uses small volumes of material for testing and produces much less biological waste.

The method will allow military and medical communities to better determine the effectiveness of current sterilants and decontaminants. It also has application on a variety of commercial segments that need testing and evaluation of decontaminants and sterilizing agents for food processing, as well as for bactericidal soaps, lotions, cleaners, paints and many other products for household and commercial use that can involve microbicidal activity. Within ECBC, the new method has been used in laboratory studies conducted in connection with the anthrax mail attacks and in military operations in Afghanistan and Iraq.

2005 Defense Standardization Program Achievement Award Winner



Dr. Jose-Luis Sagripanti was named Army winner of the 2005 Defense Standardization Program Achievement Award for his work in the development of a standard test method for efficacy of decontamination products.

The method was adopted by ASTM International as Test Method Standard E 2414-05, "Test Method for Quantitative Sporicidal Three-Step Method to Determine Sporicidal Efficacy of Liquids and Vapor or Gases on Contaminated Carrier Surfaces."

Strengthening the Industrial Base

The rapid build-up and ongoing support of chemical and biological defense equipment deployed for Operation Enduring Freedom and Operation Iraqi Freedom has stressed the current manufacturing support infrastructure. Unavailable parts and material shortages could place our warfighters at risk for not having the right piece of equipment when they need it.

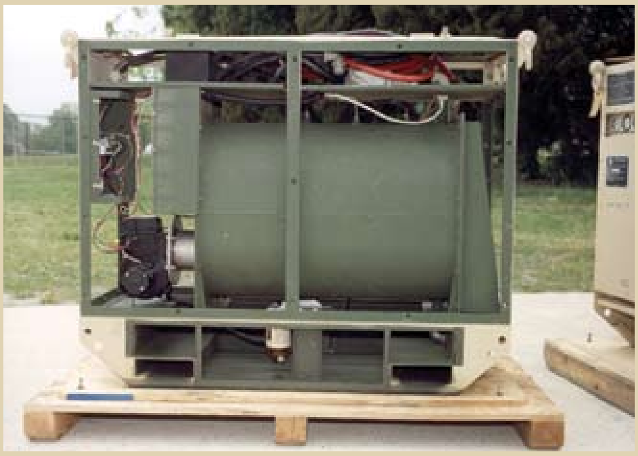
In 2005, ECBC worked hard to identify new sources of parts and material for fielded equipment. Aggressive market research and engineering innovations have been key factors in strengthening the industrial base for several pieces of equipment. The M12A1, originally fielded 35 years ago, is still the military's large-area decontamination device of choice. Several years ago, ECBC redesigned the system to convert the engine to diesel power and included parts and design changes in order for it to perform well in desert conditions. The redesign greatly improved the operational readiness of the system, increased reliability, simplified operations, and met the Department of Defense requirements for fuel standardization. Then in 2005, ECBC engineers developed a sustainment plan to support the M12A1 at a reasonable cost over the next 10 to 15 years.

The M291 Skin Decontamination Kit is used to clean the skin when it has been contaminated by liquid chemicals and is regulated by the Food and Drug Administration as a medical device approved for use on skin. In 2005, in order to meet the demands for this item to support warfighter deployments, the industrial base for the M291 needed to be expanded to include a second source of supply, in addition to the production capability at the Pine Bluff Arsenal. TrueTech was identified as a source of supply, and will begin production. Together, Pine Bluff Arsenal and TrueTech's production capabilities will ensure an adequate supply of this item for the warfighter.

The M21 Remote Sensing Chemical Agent Alarm is designed to provide warfighters standoff chemical agent detection so they can identify and maneuver around contaminated areas. It can detect both nerve and blister agents at distances up to five kilometers. The M21 is an aging system and plagued by material shortage issues and lengthy repair times. In 2005, ECBC conducted site visits with users to get direct feedback, analyzed repair activity and modified maintenance concepts to reduce cost of system repairs. Additionally, ECBC engineers recommended corrective actions to improve the M21's overall readiness status and arranged for retention of key parts with Defense Logistics Agency and the identification of alternate sources of supply. Together, these changes improved depot level maintenance, repair times and overall readiness status.

Additional Sustainment Activities in 2005

M17A1 Decontaminating Apparatus	· Resolved Obsolescence Issues
Chemical Agent Monitor/ Improved Chemical Agent Monitor	· Engineering Support for Spare Parts · Sustainment Production Contract
Chemical Biological Protection Shelter	· Engineering Support for Spare Parts
M40A1 Mask, M42A1 Mask	· Sustainment Production Contract · Sustainment Support for Spare Parts
M45 Mask, M48 Mask	· Sustainment Support for Spare Parts



ECBC also operates the Chemical, Biological, Radiological and Nuclear Equipment Hotline, which in 2005 received 343 inquiries from warfighters looking for a single source of accurate technical information on chemical and biological products and equipment. Through this hotline, not only are users able to get authoritative information on chemical and biological equipment, but engineers can study the inquiries to gain insight for equipment developers as they look to improve fielded equipment.

Working closely with TACOM and the Defense Logistics Agency and private industry, ECBC has maintained a proactive engineering and industrial base program, achieving major progress in 2005 toward improving long-term sustainment of chemical and biological equipment for the warfighter.

Helping Albania Destroy its Stockpile

Cooperative threat reduction programs, also known as Nunn-Lugar programs after US Senators Sam Nunn and Richard Lugar who sponsored the original legislation in 1991, have helped the newly independent states of the former Soviet Union destroy their weapons of mass destruction. The Defense Threat Reduction Agency's Cooperative Threat Reduction Program is responsible for coordinating United States' effort in this undertaking. In 2005, ECBC traveled to Albania to help that country begin the process of destroying 19 metric tons of chemical material.

Thirteen ECBC demilitarization experts traveled to Albania to assess and verify counts of containers and weights, and perform chemical characterization of the stockpile. ECBC completed data collection at the stockpile site, which is near the capital city of Tirana, from March to April of 2005, and reported stockpile composition characteristics, including metals content and other impurities. ECBC also verified that the Albanian government made the correct submissions detailing its chemical weapons inventory to the Organization for the Prohibition of Chemical Weapons, as required by the Chemical Weapons Convention treaty. Similarly, ECBC supported the Defense Threat Reduction Agency in evaluation of proposals for technologies that could be used in Albanian chemical warfare destruction.

In addition to performing the on-site work, ECBC helped finalize health and safety plans, procedures and operations. In 2006, ECBC will conduct follow-on work in support of demilitarization of the stockpile and site clean-up, including deploying equipment for the operations that will start in June 2006, and conducting monitoring during the process to verify agent destruction. Collective protection equipment will also be installed to protect workers and the environment during the destruction process.

Protecting the United States from the threat of weapons of mass destruction includes destroying chemical agent stockpiles around the world. If left alone, agent could fall into the hands of terrorists. At home and abroad, ECBC staff members are applying their expertise to ensure the safety of citizens and the health of our environment.

In Kuwait

Packaging Equipment for Rigorous Shipping

Over the years, the military has learned that proper packaging of equipment sent to or from the theater of operations is a complex logistics issue. The Defense Logistics Agency declares in their publication *The History and Significance of Military Packaging* that "[packaging] remains a dynamic force that can either provide a positive or negative contribution to the success of military missions. Unlike most elements of military doctrine, military packaging is rarely understood and appreciated for its contributions." Still today, a specialized piece of equipment needs to arrive on time and in top shape in order for a unit to complete a mission.

Military shipping, distribution and retrograde operations subject packaged equipment, supplies and spares to extreme conditions and adverse environments. Even items transported in the relatively protective environment of a cargo distribution container or high-priority airlift pallet can expect to be exposed in the theater of operations. Recently, the National Maintenance Program was experiencing a high "wash out" rate of unserviceable items being returned. The damage did not happen in combat but rather in transport. The high failure rate was attributed to inadequate packaging to survive extreme temperatures, humidity, rain, wind, salt, sand, dust and dirt.

From February through April 2005, ECBC personnel provided support to military packaging efforts in Camp Arifjan, Kuwait, including shipping, distribution and retrograde operations. Retrograde operations require the shipment of damaged but fixable items from theater for repair, refurbishment and, eventual return to service. Due to the high failure rate of retrograde material, the Department of the Army initiated an Army Materiel Command-sponsored effort to improve retrograde packaging operations and streamline packaging practices. In response to this needed improvement, ECBC provided hands-on support and guidance to the retrograde packaging processes.

In Kuwait, ECBC provided instruction to military personnel and guidance to contractors working in retrograde operations, including preservation, packaging and marking requirements for items being shipped back to the United States for repair. ECBC also instructed troops in fabricating shipping crates in accordance with military standards.

To improve operations and standard procedures, ECBC personnel developed lists of equipment and materials required for efficient operation. Guidance was also provided to demonstrate proper packing procedures to obtain optimal cube utilization of 20-foot containers. Detailed instructions were provided to warehouse and supplier personnel to address hazardous material shipment concerns and the related safety issues.

In Kuwait

Installing Chemical and Biological Attack Warning Systems in Kuwait Ports

Thousands of containers and people, and many ships, trains, planes and trucks pass through a port each day in order to move items to a destination. From a military standpoint, a port is the primary point where troops and equipment converge on the way to or from a theater of operation. A terrorist strike at a port, particularly if it involved weapons of mass destruction, could bring a country and a military operation to a halt.

In cooperation with the Air Force Research Laboratory, ECBC installed the Port Warning and Reporting Network System at the Port of Ash Shuaybah, Kuwait in September 2005. Commonly called PortWARN, this system is an integrated hardware and software network that provides a commander with situational awareness to include near real-time display of detector data, event management, hazard prediction and messaging. The system is made up of a series of detection nodes that communicate with a central command post through a remote data relay by either radio or Ethernet. Each detection node consists of a light tower, detector, solar panels, meteorological sensors and batteries and looks for both chemical agent and various toxic industrial chemicals. These nodes can be mobile and placed wherever a threat is perceived or operations require.

All port events, including fire, medical emergencies, intruders, facility damage and road blocks are entered into the system and tracked on a military map-based display along with reports from the detectors. Hazard predictions are then generated and available to port authorities and operational commanders.

The PortWARN system integrates nuclear, biological and chemical reports generated from other systems. Should an event occur, the system can send reports to higher headquarters, notify the port workers, and instruct alarms on the nodes themselves to activate visual and audible warnings, such as strobe lights and voice sirens. ECBC conducted a successful demonstration for military planners in June 2005 of the interoperability of PortWARN with other situational awareness tools.

In 2005, ECBC provided additional chemical and biological defense technologies for the Port of Ash Shuaybah designed to integrate with the PortWARN system. Dry filter units were installed to provide a biological sample collection and detection capability and a two-tent collective protection unit was installed to provide personnel decontamination capabilities. A blood diagnostic tool for determining chemical agent exposure was provided to the port's medical clinic, and escape hoods were supplied to dockside workers. Large- and small-scale decontamination systems were provided and transportation and distribution workers and troops were trained on their use. In 2006, the PortWARN System and related technologies will be installed at Kuwait Naval Base.